



SFD Lite Report

Guwahati India

This SFD Lite Report was:

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1 The SFD Graphic

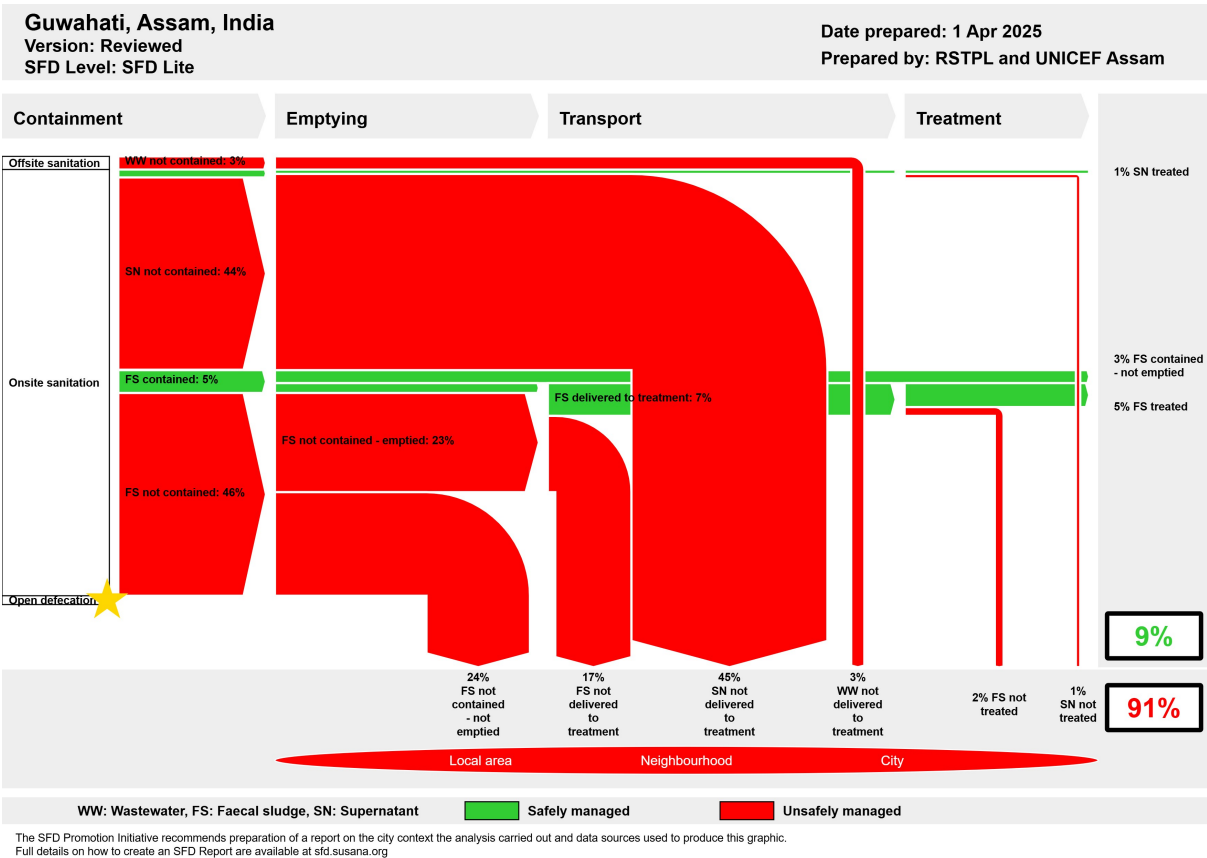


Figure 1: SFD Graphic for Guwahati (post-operation of FSTP (Faecal Sludge Treatment Plant)).

2 SFD Lite information

Produced by:

- Vikash K Agarwal (Ram Swarup Traders Pvt. Ltd., RSTPL) and the FSSM Project team of UNICEF Assam.
- This report was compiled as part of the implementation of the Faecal Sludge and Septage Management (FSSM) collaboration with the Department of Housing and Urban Affairs (DoHUA), Director Municipal Administration. Special thanks are extended to Smt. Kavitha Padmanabhan, IAS (Commissioner & Secretary to the Govt. of Assam, DoHUA), Mr Tithal Parmar (Wash Specialist, UNICEF Assam); Ms Berna Ignatius (Team Lead, FSSM Project); Key Executives of the Guwahati Municipal Corporation (GMC): Mr K Gogoi (Executive Engineer), Mr Utpal Sarmah (Procurement Officer), Mr Chandan Baishya (Junior Technical Officer), Mr Raja Singh (Cesspool Desk); Support staff of GMC, including cesspool operators, and the private operator team of the FSTP plant for their cooperation in providing primary and secondary data and participating in Key Informant Interviews (KIIs) and Focused Group Discussions (FGDs). Support from the Centre for Science & Environment (CSE), New Delhi, was instrumental in providing the framework for producing the SFD Lite report.

Collaborating partners:

- UNICEF Assam
- Guwahati Municipal Corporation, Guwahati, Assam (India)

Date of production: 01/04/2025

3 General city information

Guwahati, nestled along the Brahmaputra River at an elevation of 182.1 feet (55.5 m) above sea level, derives its name from the words 'Guwa' (fermented areca nut) and 'hati' (locality), with some interpretations linking it to 'haat' (marketplace)¹. Recognised as one of India's oldest surviving cities, Guwahati dates back to ancient times, second only to Varanasi in Uttar Pradesh in historical significance¹.



Figure 2: Aerial View - Guwahati
(Source: Vikash/2024).

As the largest metropolis in Northeast India by area and population, Guwahati serves as the region's primary gateway (Figure 2). Located at 26°10' North latitude and 92°49' East longitude¹ on the southern bank of the Brahmaputra River, the city is strategically positioned to connect the six sister states of Northeast India. Additionally, Guwahati acts as a vital cultural and commercial link to Southeast Asia, aligning with New Delhi's Look East Policy¹.

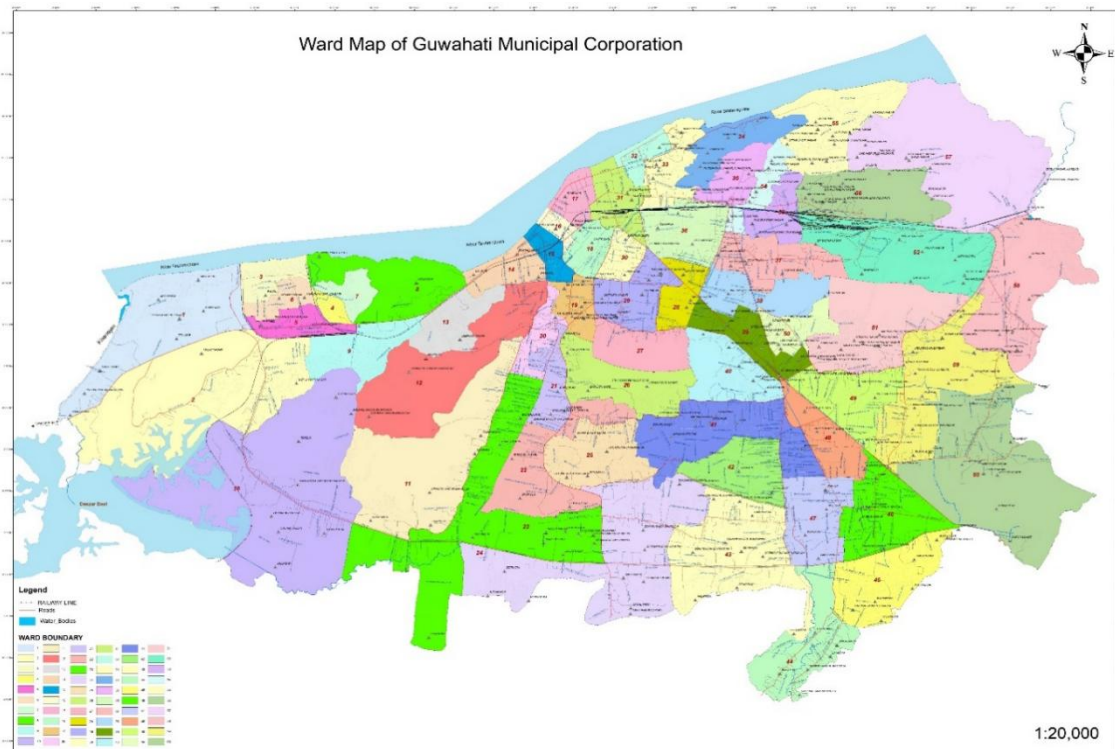


Figure 3: Ward Map of Guwahati Municipal Corporation (Source: GMC).

Guwahati City is governed by the Guwahati Municipal Corporation (GMC), covering a total area of 216.79 sq. km, divided into 60 wards². As per the 2011 Census, the city had a population of 957,352 and 229,718 households². For the SFD study, the estimated population is projected to be 1,384,197, based on the current municipal boundary and updated demographic trends. The municipal boundary and the current population are used to prepare the SFD. Additionally, a floating population of 10%³ is included, considering Guwahati's prominence as a tourist destination and the presence of landmarks such as the Kamakhya Temple (Figure 3).

¹ Draft Master Plan for Guwahati Metropolitan Area, 2045

² District Census Handbook, 2011; KII-1, 2024; ULB data; Published FSTP Request for Proposal document for Guwahati, 2023

³ FGD-1, 2024

Table 1: City Profile of Guwahati (Source: GMC).

Parameters	Values
Area	216.79 sq. km.
No. of Wards	60
Population Census (2011)	9,57,352
Population Current (Estimated)	1,384,197
Floating population (Estimated)	10%
Number of Households (HH) within Municipal Boundary	2,29,718
ODF Status	ODF+ certified
Slum population	1,39,296
No. of Slum HH	26,090
Total no. of Community Toilets	2
Total no. of Public Toilets	113

Guwahati city is situated on an undulating plain with altitudes ranging from 49.5 metres to 55.5 metres above mean sea level¹. The region's soil includes newer and older alluvial soils, as well as soils found in forested and hilly areas⁴. The city experiences an average annual temperature of 22.2°C, with extremes of 39.5°C (recorded on April 24, 2014) and 2.0°C (recorded in January 1964)¹. The average annual rainfall is 1,751.8 mm, spread across 91.9 rainy days, and the average relative humidity of 72%¹.

Two primary natural drainage channels, the Bharalu and Basistha, serve the Guwahati Metropolitan Region:

- The Bharalu channel drains directly into the Brahmaputra River.
- The Basistha channel flows into Deepor Beel via the Mora Bharalu channel, which connects to the Brahmaputra through the Konna Jan stream.

Presently, Guwahati faces significant wastewater management challenges, with untreated wastewater being discharged into open stormwater drains throughout the city. This untreated effluent eventually flows into the Brahmaputra River, posing severe environmental and public health risks.

Guwahati's water supply is sourced primarily from surface water and groundwater¹. The GMC operates three water treatment plants located at Panbazar, Satpukhuri, and Kamakhya. These plants draw water from the Brahmaputra River, which is treated and then pumped to reservoirs atop hilltops for distribution through gravity mains. Some areas also rely on direct pumping systems. Additionally, the city has eight functional deep tube wells located across various sites⁴. In addition, to ensure 100% potable water supply coverage, projects assisted by the Government of India (Atal Mission) and the Japan International Cooperation Agency (JICA) are also undertaken¹.

⁴ Ground Water Information Booklet of Kamrup & Kamrup Metro District, Assam, 2013; Draft Master Plan for Guwahati Metropolitan Area, 2045

The risk of groundwater contamination is considered to be minimal due to the depth of borewells, which exceed 10 metres. However, groundwater does have the presence of contaminants like iron (Fe). The soil structure and geological conditions further contribute to reducing the contamination risk⁵.

4 Service outcomes

4.1 SFD matrix



Figure 4: The Used Water Flowing into the Brahmaputra (Source: Vikash/2024).

Guwahati's rapid urbanization has significantly outpaced its sanitation infrastructure, resulting in numerous critical challenges. The city faces issues such as improperly managed faecal sludge, poorly designed septic tanks, and frequent sewage overflows during the monsoon season⁶. The majority of households rely on onsite sanitation systems, which often do not meet prescribed design standards and are rarely emptied or serviced at recommended intervals. Although mechanized alternatives for faecal sludge management are available, manual scavenging persists as a widespread practice⁷.

Further compounding these challenges is the absence of adequate municipal-level Sewage Treatment Plants (STPs)⁶, leaving the city ill-equipped to handle its increasing sanitation demands. However, the reliance on onsite sanitation systems still accounts for 97% of the city's infrastructure, while offsite systems make up only 3%, highlighting significant disparities in coverage and effectiveness (Figure 4).

Table 2: Sanitation System Breakdown (Source: SFD study).

System Type	Estimated Population (%)	Transported Safely	Treated Safely
Onsite Sanitation Systems	97%	Limited	Insufficient
Offsite Sanitation Systems	3%	Insufficient	Lacking
Open Defecation/Direct Discharge	Minimal but Persistent	Unsafe	None

These inadequacies pose severe environmental and public health implications, affecting the quality of life for residents and endangering the health of water bodies such as the Bharalu River, which eventually feeds into the Brahmaputra River (Figure 5 and Figure 6).



Figure 5: The Becoming of a Used Water Conveyance Channel: Bharalu and other channels (Source: Vikash/2024).

⁵ Ground Water Information Booklet of Kamrup & Kamrup Metro District, Assam, 2013; FGD-4, 2024; FGD-7, 2024; FGD-8, 2024

⁶ Field Observations; Draft Master Plan for Guwahati Metropolitan Area, 2045; FGD-2, 2024

⁷ Field Observations; FGD-2, 2024



Figure 6: Overflowing Drain due to Water Pipe Leakage; Blocked Drain; Nullah/Drain (Source: Vikash/2024).

Table 3 provides a breakdown of the city's sanitation systems, highlighting the estimated population served by each system and the proportions of faecal sludge or wastewater that are transported and treated effectively within both onsite and offsite sanitation setups. This underscores the urgent need for comprehensive and sustainable solutions to address the city's growing sanitation challenges.

Table 3: SFD Matrix for Guwahati.

Guwahati, Assam, India, 1 Apr 2025. SFD Level: SFD Lite

Population: 1384197

Proportion of tanks: septic tanks: 64%, fully lined tanks: 50%, lined, open bottom tanks: 100%

Containment										
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4d	S5d	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in sewer system, which is delivered to treatment plants	Proportion of supernatant in sewer system that is delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	2.0	0.0	0.0							
T1A1C8 Toilet discharges directly to open ground	1.0									
T1A2C3 Septic tank connected to a decentralised combined sewer	5.0			50.0	30.0	75.0	50.0	50.0		
T1A2C5 Septic tank connected to soak pit	2.0			50.0	30.0	0.0				
T1A2C6 Septic tank connected to open drain or storm sewer	5.0			50.0	30.0	75.0			0.0	0.0
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	84.0			50.0	30.0	75.0			0.0	0.0
T1B10C10 Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow	1.0			0.0	30.0	75.0				

Overview of technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

4.1.1 Offsite sanitation

Guwahati lacks a piped sewerage system and does not have an operational municipal-level Sewage Treatment Plant (STP)⁶. As a result, untreated sewage is directly discharged into natural water bodies, including the Bharalu River, which ultimately flows into the Brahmaputra River⁶. This absence of centralized sewage infrastructure poses significant environmental and public health challenges.

However, the state government has allocated ₹1,460 crores (\$175.57 million USD) for the construction of three STPs (at Silsako Beel (65 Million Litres per Day, MLD), Borsola Beel (62 MLD) and Paschim Boragaon (60 MLD)) with a combined treatment facility of 187 MLD⁸. Additionally, an extensive sewerage network of 872 km is proposed to cover the residents of the southern and central zones of the city⁸. Recently (in July 2025), the Guwahati Metropolitan Development Authority (GMDA)⁹ inaugurated a 2 MLD STP in Borsola Beel¹⁰. The STP based on Upflow Anaerobic Sludge Blanket (UASB) and Trickling Filter will treat used water from eight wards (Ward 18, 30, 31, 32, 33, 34, 35 and 36)¹⁰.



Figure 7: Night Soil Discharged Directly into Open Drains, Water Bodies and Open Drains (Source: Vikash/2024).

Approximately 2% of the population (T1A1C6) rely on toilets that discharge directly into open drains, categorized as Night Soil Disposed in Open Drains (NSOD)¹¹. Additionally, 1% of the population (T1A1C8) have toilets that discharge directly onto open ground¹¹. These practices are primarily observed in informal settlements and areas with poor toilet infrastructure within the municipal boundary (Figure 7 and Figure 8).



Figure 8: Drains in and around the Slum (Source: Vikash/2024).

⁸ GPlus (2025); Field Observations

⁹ Nodal agency for the planned development of Guwahati

¹⁰ GMDA

¹¹ Field Observations; FGD-7, 2024; FGD-8, 2024

Guwahati generates an estimated 149 MLD of wastewater¹², based on an assumption of 135 litres per capita per day (lpcd). Currently, wastewater and supernatant from households are directly discharged into open grounds or natural drainage channels (*nullahs*) without treatment¹². Consequently, in the Shit Flow Diagram (SFD) matrix, variables W4c (proportion of wastewater delivered to treatment) and W5c (proportion of wastewater treated) are considered 0%, reflecting the absence of effective wastewater treatment infrastructure.

4.1.2 Onsite sanitation (OSS)

A significant portion (97%) of Guwahati's population relies on OSS, primarily septic tanks, which are often connected to open drains. These septic tanks are typically not designed to the Bureau of Indian Standards (BIS) guidelines, leading to inefficiencies in faecal sludge management¹². Emptying is performed on a need basis, usually triggered by overflow or odour, rather than through regular periodic maintenance¹².

Containment: In Guwahati, the containment systems vary across the city and are categorized as follows:

Septic Tank Connected to Decentralized Combined Sewer (T1A2C3): This accounts for 5% of the population, primarily found in large societies or apartments equipped with functional decentralized Sewage Treatment Plants (STPs) within the municipal boundary.

Septic Tank Connected to Soak Pit (T1A2C5): This covers 2% of the population, where wastewater is partially treated through soak pits, but efficiency varies based on soil conditions and design (Figure 9).

Septic Tank Connected to Open Drain or Storm Sewer (T1A2C6): Represents 5% of the population, with septic tanks discharging untreated effluents into stormwater drainage systems.

Fully Lined Tank (Sealed) Connected to Open Drain or Storm Sewer (T1A3C6): The most prevalent system, serving 84% of the population, involves fully lined tanks discharging directly into open drains or storm sewers.

Failed, Damaged, Collapsed, or Flooded Containment Systems with No Outlet or Overflow (T1B10C10): These account for 1% of the population, representing systems that are non-functional or compromised.



Figure 9: Septic Tank (Source: Vikash/2024).

The size and design of on-site containment systems in Guwahati contrast with the CPHEEO (Central Public Health and Environmental Engineering Organisation) guidelines for septic tank construction and emptying. These septic tanks typically vary in size and are predominantly 3-chambered structures with sealed and plastered bottoms. Field observations and Focus Group Discussions (FGDs) revealed the following dimensions for several septic tanks in Guwahati¹³:

¹² Draft Master Plan for Guwahati Metropolitan Area, 2045; Published FSTP Request for Proposal document for Guwahati, 2024; FGD-1, 2024; FGD-2, 2024; FGD-3, 2024; FGD-7, 2024; FGD-8, 2024

¹³ FGD-1, 2024; FGD-2, 2024; FGD-3, 2024; FGD-4, 2024; FGD-5, 2024; FGD-6, 2024; CPHEEO

Table 4: Observed Septic Tank Dimensions for Varied Users (Source: Field Observations; FGDs).

Length (m)	Width (m)	Depth (m)
1.83	1.22	1.22
1.83	1.22	1.83
1.83	1.22	3.05
1.83	0.91	0.91
2.44	1.07	1.52
3.05	1.37	1.83
4.57	0.91	2.13
5.49	2.44	2.44
6.10	2.44	2.13
6.71	3.05	3.05
9.14	3.05	3.05

Community Toilets/Public Toilets: Guwahati has a total of two community toilets (CTs) and 113 public toilets (PTs)¹⁴, which serves both residents and visitors (Figure 10 and Figure 11). The public toilets were constructed under the Swachh Bharat Mission (SBM) and by various NGOs. Most operate as pay-and-use facilities, while public toilets located at petrol pumps, shopping malls, and parks are free to use. Some previous government initiatives, like smart e-toilets at various locations, have not been successful, as these facilities are currently non-functional¹⁵.



Figure 11: Wall for Nature's Call in a Marketplace (now being dismantled for public amenities) (Source: Vikash/2024-25).

The PTs play an important role in helping the floating and working population address their daily need for nature's call. However, due to non-maintenance, theft, and improper staff rotation, users face difficulties in accessing a few toilets, specifically during odd hours¹⁶.

Any unhygienic conditions in toilets make them difficult for female users to access. The above just forces many citizens to urinate in the open, deserted, and dark areas and in open drains¹⁶.

The CTs and PTs rely on septic tanks, which are often connected to open drains or storm sewers and are mechanically emptied in 3-4 years¹⁴. Guwahati was officially declared Open Defecation Free (ODF) in 2017¹⁷. However, the city still faces significant challenges, particularly in its 72 Harijan Colonies and numerous



Figure 10: Signage Board for Nature's Call in a Marketplace (Source: Vikash/2025).

¹⁴ KII-1, 2024; KII-3, 2024; FGD-4, 2024; GMC published data available on the office premises; Draft Master Plan for Guwahati Metropolitan Area, 2045; Field Observations

¹⁵ Times of India (2024); Field Observations

¹⁶ GPlus (2024); Field Observations

¹⁷ KII-1, 2024; KII-2, 2024

legal and illegal settlements spread across the municipal boundary¹⁸ (Figure 12, Figure 13 and Figure 14).



Figure 12: Public Toilets (Source: Vikash/2024).



Figure 13: Public Toilets – Usage Fees (Source: Vikash/2024).

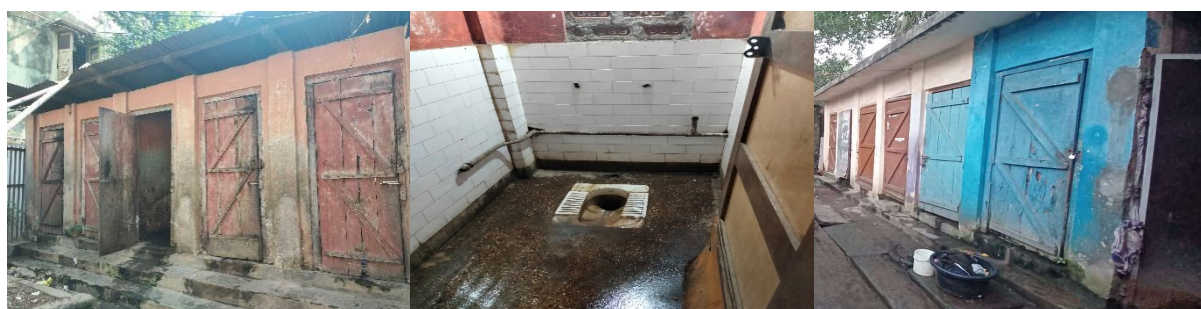


Figure 14: Community Toilets (Source: Vikash/2024).

During field visits, many of these unregulated settlements were found to be in dilapidated conditions with poor sanitation facilities.

The absence of adequate and functional toilet facilities can result in behavioural issues, and such individuals in these vulnerable communities may have no choice but to defecate in the open¹⁸. This issue becomes more acute during the rainy season, as many of these settlements are prone to flooding, which heightens the risk of contamination and exposes residents to serious health hazards.

Emptying: The containment boxes or septic tanks are mostly not designed as per BIS standards. The masons/contractors have a say in the size of the tanks, with the same being constructed largely to minimize any emptying requirement for a longer period of time¹⁹. Residents emptied the tanks as needed (when there is an overflow or considerable foul-smelling emissions).



Figure 15: The Cesspool Control Team of GMC (Source: Vikash/2024).

¹⁸ Field Observations; FGD-7, 2024

¹⁹ Field Observations; FGD-3, 2024; FGD-7, 2024; FGD-8, 2024;

In Guwahati, containment systems are emptied on a need basis by users, employing either mechanized cesspool trucks or manual emptiers (Figure 15).



Figure 16: Usage Charges (Source: Vikash/2024).

For mechanized emptying in Guwahati, the Guwahati Municipal Corporation (GMC) offers two booking methods: in-person at their Ulubari office or online through the website <https://sewasetu.assam.gov.in/> (formerly <https://rtps.assam.gov.in/>)²⁰.

The pricing structure for this service is based on a standard containment size of 300 cubic feet (8.50 cubic metres): for residential use, ₹2,000/- (\$22 USD) and for commercial use, ₹4,000/- (\$45 USD). For volumes exceeding 300 cubic feet (8.50 cubic metres), an additional charge is applied: residential, ₹6/- (\$0.06 USD) per extra cubic foot and commercial: ₹12/- (\$0.12 USD) per extra cubic foot. A Tatkal (urgent) service is also available at an additional cost of ₹2,000/- (\$22 USD). Typically, GMC handles 30-40 bookings per week for

mechanized emptying²¹ (Figure 16).

However, the demand tends to decline during the rainy season, and the service is often limited for households located on hill slopes due to the suction limitations of pump equipment. This highlights the need for alternative strategies to ensure effective faecal sludge management in geographically challenging areas.

Separately, the field survey identified around 72 Harijan Colonies²², where some residents engage in part-time manual emptying of faecal sludge. While the exact number of manual emptiers is uncertain, it is estimated that approximately 1,080 workers are involved, assuming an average of 15 workers per colony.

These workers typically operate at night in groups of 3-5 individuals, and charges vary from ₹2,000/- to ₹15,000/- (\$22 USD to \$171 USD) based on the containment size and service area. For big apartments, charges range between ₹10,000/- to ₹30,000/- (\$114 USD to \$342 USD) based on the containment size and service area. The faecal sludge is manually removed using spades and tin boxes and is disposed of either on open ground (when available) or into the nearby drains, creating significant environmental and public health hazards. The situation is further exacerbated by the presence of non-biodegradable waste such as plastics (including condoms, sanitary napkins, etc.) mixed with faecal matter. Additionally, there are significant behavioural and safety challenges, as sanitation workers often do not use proper safety gear during the emptying process, thereby exposing themselves to severe health hazards²² (Figure 17).



Figure 17: Manual Emptying (Source: Vikash/2025).

Therefore, variable F3 (proportion of faecal sludge emptied) is set at 50% for all systems, except for system T1B10C10 (containment failed, damaged, collapsed, or flooded — with no outlet or overflow), which is assigned a value of 0% in the SFD matrix.

Transportation: In Guwahati, the GMC manages a fleet of 11 cesspool vehicles with capacities of 1,000 litres, 3,000 litres, and 5,000 litres²³. These vehicles typically make 1-3 trips per day to collect and transport faecal sludge from various locations (Figure 18 and Table 5). However, the demand for cesspool services significantly decreases or is non-existent during the monsoon season. The collected sludge is now transported to a now operational 20KLD FSTP site at Boragaon (Latitude: 26.10786, Longitude: 91.69227). Previously, the collected sludge used to be transported to a designated

²⁰ Internal reports of the TSU-FSSM team; KII-3, 2024; FGD-1, 2024; FGD-2, 2024

²¹ FGD-9, 2024-25; KII-3, 2024

²² Field Observations; FGD-2, 2024; FGD-7, 2024

²³ KII-3, 2024; FGD-2, 2024; FGD-9, 2024-25

dumping site located in Boragaon (Latitude: 26.11575, Longitude: 91.67793) within the municipal boundary, which is now non-operational²³.



Figure 18: Cesspool Vehicles (Source: Vikash/2024-25).

Table 5: Cesspool Vehicles Engaged by GMC.

#	Type of Vehicle	No. of Vehicles
1	Big Cesspool	4
2	Mini Cesspool	7
	Total	11

GMC is making efforts in the promotion of the cess poll vehicles through signages and social media, and creating public awareness on the importance of not dumping septic tank waste into water bodies. Recently, to deter such practice, a household was fined ₹45,000/- (\$513 USD) for dumping toilet waste in the Basistha River²⁴. Signages specify a three-year time period for regular emptying of septic tanks by a licensed operator (Figure 19).

Despite regulations, manual emptying of faecal sludge continues to be practised within the municipal limits. The sludge is transported using small-sized vehicles, cesspool-type carriers, or manually handled through tins and drums with capacities ranging from 10 to 100 litres, typically involving 2–3 drums per service. This manually collected sludge is frequently dumped on open ground or into open drains - often discreetly - to avoid public scrutiny²². Such unregulated transportation and disposal practices pose serious environmental and public health risks, including the contamination of local water bodies such as the Bharalu and Brahmaputra rivers. The lack of adequate sewage treatment infrastructure further exacerbates the problem, with untreated sewage directly contributing to escalating water pollution levels.



Figure 19: Emptying of Septic Tanks Awareness Campaign (Source: Vikash/2025).

Further complicating the situation, many drains overflow into open grounds and ponds or become stagnant due to blockages or encroachments, creating additional environmental and public health challenges. Given the insufficient/lack of centralized or decentralized treatment facilities, the variables F4 (proportion of faecal sludge effectively delivered to treatment plants) is considered at 30% and S4e (proportion of wastewater treated in a centralized manner) is considered at 0% in the Shit Flow Diagram (SFD) matrix. This underscores the urgent need for systematic interventions to improve faecal sludge management, drainage infrastructure, and treatment capabilities in the city.

²⁴ GMC

Treatment/Disposal: To address this issue, the Guwahati Municipal Corporation (GMC) constructed a 20 KLD FSTP²⁵ based on Geobags and supported treatment units at a cost of ₹3.99 crores (\$455,140 USD) based on the Design-Build-Operate-Transfer model for five years¹⁶. The FSTP was officially inaugurated on 02 October 2024.



Figure 20: FSTP at Boragaon (Source: Vikash/2025).

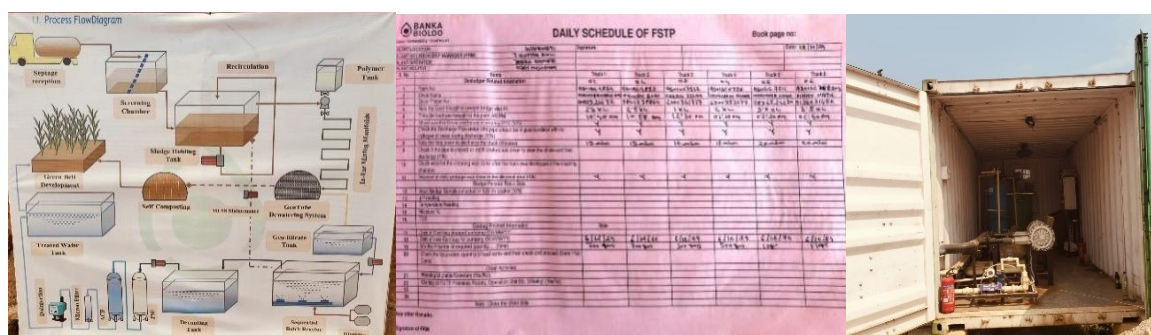


Figure 21: FSTP Operations at Boragaon (Source: Vikash/2025).

The liquid faecal sludge collected is discharged into the screening chamber and onwards to the gravity-based and mechanised treatment system based on Geobags (Figure 20 and Figure 21). The final treated liquid is either reused by GMC for road cleaning or horticultural purposes or discharged into the nearby drain²⁶. The facility has been reporting 100% utilisation with instances of not being able to support additional load in days when cesspool vehicles have to return for not being able to empty the load at the designated FSTP site²⁶. Information could not be gathered on what fate the unemptied containment is subjected to from the cesspool vehicle for such instances. GMC is making provisions to cater to the additional demand through the construction of an additional FSTP capacity system at the same site. Further, composting of the dried treated faecal sludge is not fully operational at the moment, and the facility is a work-in-progress.



Figure 22: Designated Discharge Point at Boragaon before the Functional FSTP (Source: Vikash/2024).

Before the construction of the FSTP, the mechanized collection of faecal sludge in Guwahati was emptied into three pit-like holding tank structures located at Boragaon²⁶ (Figure 22). These structures had semi-permeable walls and were surrounded by open ground, and were inadequate for proper

²⁵ FGD-1, 2024

²⁶ Field Observations; FGD-9, 2024-25

sludge management. During heavy rains or floods, these pits were often submerged in water, further exacerbating the risks of contamination and environmental pollution²⁶.

Given the insufficient/absence of treatment facilities at present, the variables F5 (proportion of faecal sludge effectively treated) is considered at 75% and S5e (proportion of wastewater treated after emptying) is assigned 0% in the Shit Flow Diagram (SFD) matrix, underscoring the need for swift implementation of the planned treatment infrastructure.

4.1.3 SFD Graphic before commissioning of the FSTP

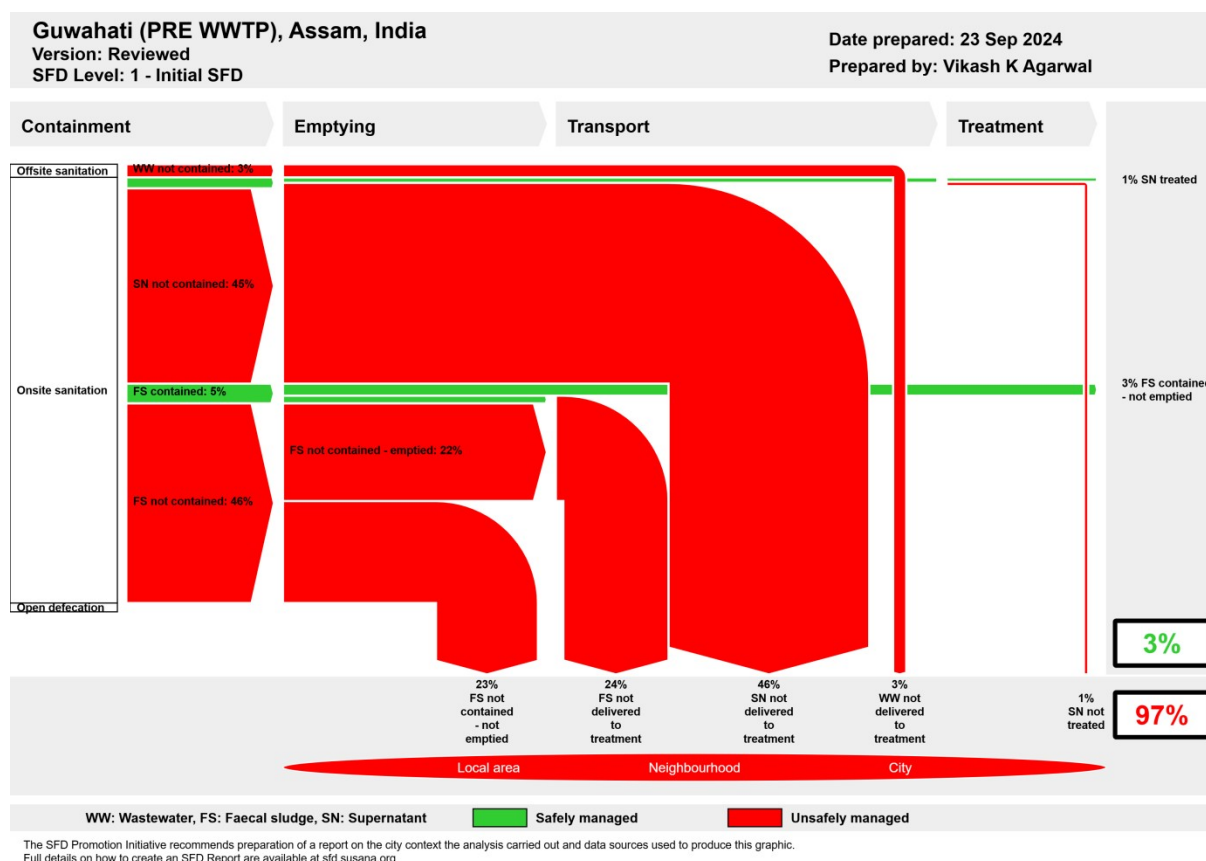


Figure 23: SFD Graphic for Guwahati (Before Commissioning of the 20KLD FSTP).

Overall, 97% of the faecal sludge is considered to be unsafely managed and discharged to the environment in the sanitation value chain, with only 3% estimated to be safely managed as per the SFD graphic and on the basis of the assumptions (Figure 23).

4.1.4 Groundwater Pollution

To assess the vulnerability of the aquifer in Guwahati, the following assumptions were made:

Groundwater Pollution Risk: The risk is considered low because the groundwater table is assumed to be at depths greater than 10 metres.

Water Production Technology: Groundwater extraction is carried out using protected boreholes, protected dug wells, or protected springs, with adequate sanitary measures in place to minimize contamination risks.

Groundwater Supply Contribution: It is assumed that more than 25% of the water supply is sourced from groundwater.

Sanitation Facilities Proximity to Groundwater Sources: The percentage of sanitation facilities located less than 10 metres from groundwater sources is estimated at less than 25%. The percentage of sanitation facilities located uphill of groundwater sources is also estimated at less than 25%, reducing the likelihood of contamination.

Rock Type in the Unsaturated Zone: The unsaturated zone is assumed to consist of fine sand, silt, and clay, materials that can act as natural filters and reduce the mobility of contaminants.

These assumptions suggest that while the aquifer has some inherent protection due to depth and geological conditions, there are still vulnerabilities that need monitoring, especially in areas where sanitary measures may not be fully implemented or where sanitation facilities are located near or above groundwater sources.

4.2 SFD Graphic

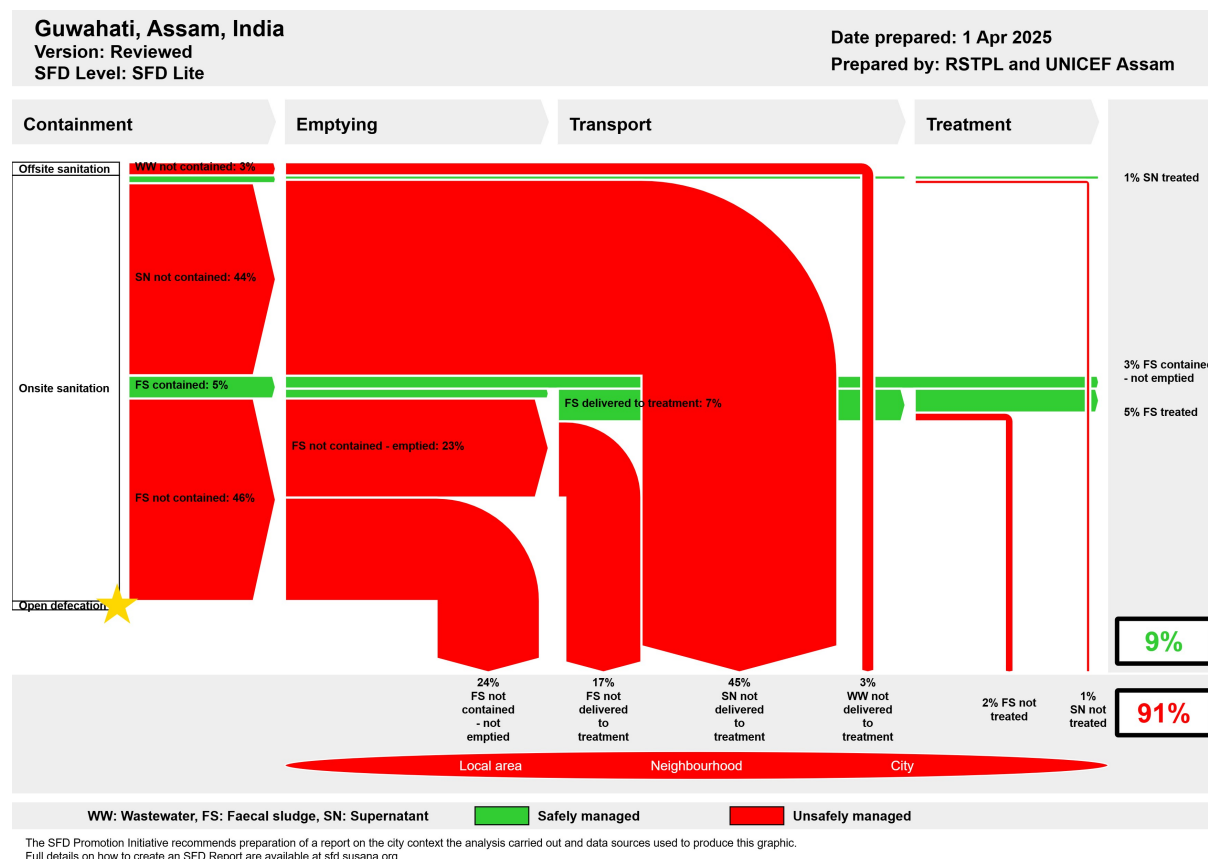


Figure 24: SFD Graphic for Guwahati (post-operation of FSTP (Faecal Sludge Treatment Plant)).

Overall, 91% of the faecal sludge is considered to be unsafely managed and discharged to the environment in the sanitation value chain, with only 9% estimated to be safely managed as per the SFD graphic and on the basis of the assumptions (refer to Figure 1 and Figure 24).

The commissioning of the 20KLD FSTP on 02 October 2024 has provided an improvement to the excreta management of Guwahati in terms of treatment. The produced SFD graphic before and after the FSTP plant shows a marginal improvement in the safely managed excreta flow from 3% to 9%. The unsafely managed excreta that flows to the environment is 97% (pre-FSTP) and 91% (post-FSTP).

Assumptions remain the same for both the SFD graphics, except for the two variables below, F4 and F5. The variable F4 (proportion of faecal sludge effectively delivered to treatment plants) is considered at 30% in the post-FSTP SFD graphic to account for the faecal sludge that is transported to the treatment facility. Variable F5 (proportion of faecal sludge effectively treated) is considered at 75% in the post-FSTP SFD graphic to account for the faecal sludge that is assumed to be treated in the treatment facility. In the pre-FSTP, SFD graphic, both variables, F4 and F5, are assigned 0%.

Data on Unsafely Managed Excreta:

- 24%: Faecal sludge (FS) that is not properly contained.
- 17%: FS that is not delivered to treatment facilities.
- 45%: Supernatant (SN) that is not delivered to treatment facilities.
- 3%: Wastewater (WW) that is not delivered to treatment facilities.
- 2%: FS that is not treated.
- 1%: SN that is not treated.

Breakdown of Safely Managed Excreta:

- 1%: SN that is properly treated.
- 3%: FS that is contained but not emptied, indicating it is safely stored without significant risk of groundwater contamination.
- 5%: FS that is treated.

These figures underscore the critical sanitation challenges in Guwahati, with the vast majority of excreta flows being unsafely managed due to inadequate containment, transportation, and treatment infrastructure. The 3% safely managed sanitation represents faecal sludge securely stored in containment systems, minimizing risks to groundwater pollution, and a small portion of supernatant that is effectively treated.

Guwahati currently also lacks a municipal-level Sewage Treatment Plant (STP), which significantly impacts the city's ability to manage wastewater and faecal sludge effectively. Plans are underway to establish STPs, with Detailed Project Reports (DPRs) and tender processes already in progress²⁵. Additionally, various studies have been conducted to address the issues of sewage and effluent inflow into critical water bodies, such as the Bharalu River, Deepor Beel, and the Brahmaputra River, all of which suffer from untreated discharges.

This situation underscores the urgent need for comprehensive improvements in sanitation infrastructure to effectively manage wastewater and faecal sludge. Establishing operational STPs, additional FSTP capacities, implementing proper containment systems and ensuring timely emptying and treatment are crucial to increasing the proportion of safely managed excreta. Such measures would not only improve public health outcomes but also protect the city's valuable water resources from further pollution.

5 Data and assumptions

To develop the SFD Lite report for Guwahati, the Census 2011 data was used as the baseline, and the sanitation chain stages were updated using a combination of field data from Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), field observations, and secondary data from relevant stakeholders. The following assumptions were made during the process:

Faecal Sludge Composition: The proportion of FS in septic tanks, fully lined tanks, and lined, open bottom tanks are considered 64%, 50%, and 100% respectively as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.

Wastewater Generation: The volume of wastewater generated was estimated as 80% of the water supplied to households and other establishments.

Effective Population: The effective population was calculated based on the availability of secondary data and inputs from KII with stakeholders.

On-Site Sanitation (OSS) Emptying: The proportion of OSS systems emptied was assumed to be 30%. This figure was derived by dividing the average number of households emptied annually by the total number of households, considering a three-year minimum required emptying cycle.

Septic Tank Design and Maintenance: It was assumed that septic tanks are not designed as per BIS. Since they are not emptied periodically, septic tanks were classified as Fully Lined Tanks in the analysis.

6 List of data sources

Reports and literature

- Draft Master Plan for Guwahati Metropolitan Area, 2045
- District Census Handbook, 2011
- Ground Water Information Booklet of Kamrup & Kamrup Metro District, Assam, 2013
- Published FSTP Request for Proposal document for Guwahati, 2023
- GMC published data available on the office premises
- Guwahati Municipal Corporation – Swachh Bharat Mission presentation, 2023

Key informant interviews

- KII-1, 2024: Mr Utpal Sarmah, Procurement Officer, GMC
- KII-2, 2024: Mr Chandan Baishya, Junior Technical Officer, GMC
- KII-3, 2024: Mr Raja Singh and Mr Raju Ali, Cesspool Desk, GMC
- KII-4, 2024: Mr N. Das, Town Planner, GMC
- KII-5, 2024: Mr Rupjyoti Talukdar, Executive Engineer, Guwahati Metropolitan Drinking Water & Sewerage Board
- KII-6, 2024: Dr. Shantanu Dutta, Former Member Secretary, Assam Pollution Control Board
- KII-7, 2024: Mr Mrinmoy Das, Maa Kamakhya Devalaya
- KII-8, 2024: Mr Anand Aiyar, Lions Club of Guwahati



Figure 25: Key Informant Interviews (Source: Vikash/2024).

Focus group discussions

- FGD-1, 2024: Focus Group Discussion with Guwahati Municipal Corporation officials
- FGD-2, 2024: Focus Group Discussion with Manual Scavengers
- FGD-3, 2024: Focus Group Discussion with Mason and Civil Contractors
- FGD-4, 2024: Focus Group Discussion with Maintenance Staff of Public Toilets
- FGD-5, 2024: Focus Group Discussion with Plumbers and Boring Personnel
- FGD-6, 2024: Focus Group Discussion with Architects & Engineers
- FGD-7, 2024: Focus Group Discussion with Random HHs in Slum Areas
- FGD-8, 2024: Focus Group Discussion with Random HHs in the Municipal area
- FGD-9, 2024-25: Focus Group Discussion with Cess Pool Team



Figure 26: Key Informant Interviews (Source: Vikash/2024).

Field Observations

- Survey of Public Toilets and Community Toilets
- Random visit to households covering Lower Income Groups (LIG), Middle Income Groups (MIG) and Higher Income Groups (HIG) spread throughout the city
- Survey of dumping ground at Boragaon, Guwahati



Figure 27: Field Observations (Source: Vikash/2024).

Guwahati, India, 2025

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